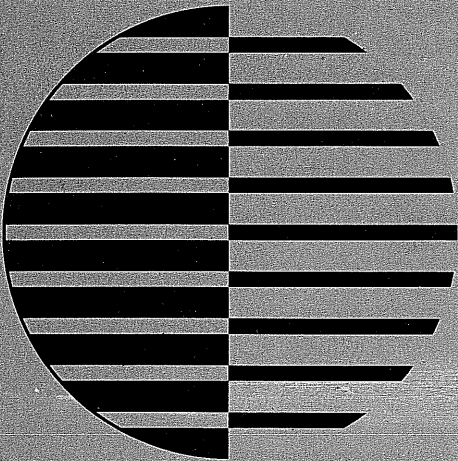


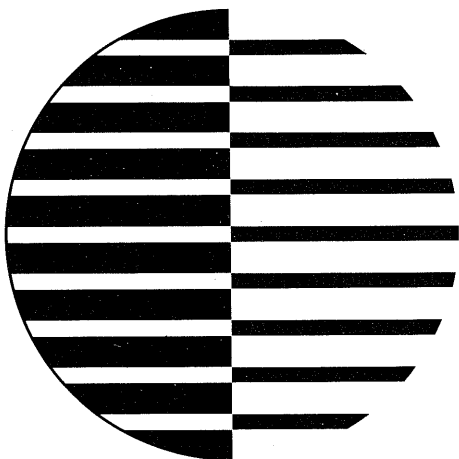
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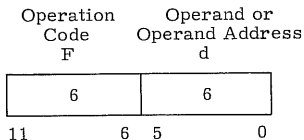


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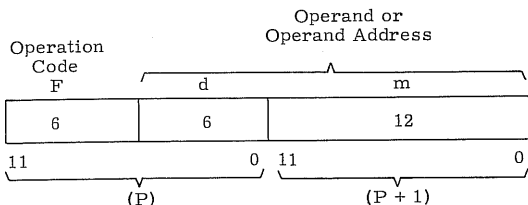
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EXPLANATION OF PERIPHERAL AND CONTROL PROCESSOR INSTRUCTION FORMATS

An instruction may have a 12-bit or a 24-bit format. The 12-bit format has a 6-bit operation code F and a 6-bit operand or operand address d.



The 24-bit format uses the 12-bit quantity m, which is the contents of the next program address (P + 1), with d to form an 18-bit operand or operand address.



EXPLANATION OF SYMBOLS USED IN PERIPHERAL AND CONTROL PROCESSOR INSTRUCTION LISTINGS

d	Implies d itself
(d)	Implies the contents of d
((d))	Implies the contents of the location specified by d
m	Implies m itself used as an address
m + (d)	The contents of d are added to m to form an operand (jump address).
(m + (d))	The contents of d are added to m to form the address of the operand
dm	Implies an 18-bit quantity with d as the upper 6 bits and m as the lower 12 bits

PERIPHERAL AND CONTROL PROCESSOR INSTRUCTIONS

All times are given in major cycles

One major cycle = 1000 nanoseconds

1. NUMERICAL LISTING

<u>F</u>	<u>MNE- MONIC</u>	<u>AD- DRESS</u>	<u>NAME</u>	<u>TIME (Major Cycles)</u>
00	PSN		Pass	1
01	LJM	m d	Long jump to m + (d)	2-3
02	RJM	m d	Return jump to m + (d)	3-4
03	UJN	d	Unconditional jump d	1
04	ZJN	d	Zero jump d	1
05	NJN	d	Nonzero jump d	1
06	PJN	d	Plus jump d	1
07	MJN	d	Minus jump d	1
10	SHN	d	Shift d	1
11	LMN	d	Logical difference d	1
12	LPN	d	Logical product d	1
13	SCN	d	Selective clear d	1
14	LDN	d	Load d	1
15	LCN	d	Load complement d	1
16	ADN	d	Add d	1
17	SBN	d	Subtract d	1
20	LDC	dm	Load dm	2
21	ADC	dm	Add dm	2
22	LPC	dm	Logical product dm	2
23	LMC	dm	Logical difference dm	2
24	PSN		Pass	1
25	PSN		Pass	1
260	EXN		Exchange jump*	
261	MXN		Monitor exchange jump**	

*In 6500 System, Bit 0 specifies which CP the Exchange Jump will interrupt.

**Standard Option 10103 for 6400; Standard Option 10104 for 6600.

<u>F</u>	<u>MNE- MONIC</u>	<u>AD- DRESS</u>	<u>NAME</u>	<u>TIME (Major Cycles)</u>
27	RPN		Read program address	1
30	LDD	d	Load (d)	2
31	ADD	d	Add (d)	2
32	SBD	d	Subtract (d)	2
33	LMD	d	Logical difference (d)	2
34	STD	d	Store (d)	2
35	RAD	d	Replace add (d)	3
36	AOD	d	Replace add one (d)	3
37	SOD	d	Replace subtract one (d)	3
40	LDI	d	Load ((d))	3
41	ADI	d	Add ((d))	3
42	SBI	d	Subtract ((d))	3
43	LMI	d	Logical difference ((d))	3
44	STI	d	Store ((d))	3
45	RAI	d	Replace add ((d))	4
46	AOI	d	Replace add one ((d))	4
47	SOI	d	Replace subtract one ((d))	4
50	LDM	m d	Load (m + (d))	3-4
51	ADM	m d	Add (m + (d))	3-4
52	SBM	m d	Subtract (m + (d))	3-4
53	LMM	m d	Logical difference (m + (d))	3-4
54	STM	m d	Store (m + (d))	3-4
55	RAM	m d	Replace add (m + (d))	4-5
56	AOM	m d	Replace add one (m + (d))	4-5
57	SOM	m d	Replace subtract one (m + (d))	4-5
60	CRD	d	Central read from (A) to d	min. 6
61	CRM	m d	Central read (d) words from (A) to m	5 plus 5/word

<u>F</u>	<u>MNE-MONIC</u>	<u>AD-DRESS</u>	<u>NAME</u>	<u>TIME (Major Cycles)</u>
62	CWD	d	Central write to (A) from d	min. 6
63	CWM	m d	Central write (d) words to (A) from m	5 plus 5/word
64	AJM	m d	Jump to m if channel d active	2
65	IJM	m d	Jump to m if channel d inactive	2
66	FJM	m d	Jump to m if channel d full	2
67	EJM	m d	Jump to m if channel d empty	2
70	IAN	d	Input to A from channel d	2
71	IAM	m d	Input (A) words to m from channel d	4 plus 1/word
72	OAN	d	Output from A on channel d	2
73	OAM	m d	Output (A) words from m on channel d	4 plus 1/word
74	ACN	d	Activate channel d	2
75	DCN	d	Disconnect channel d	2
76	FAN	d	Function (A) on channel d	2
77	FNC	m d	Function m on channel d	2



2. ALPHABETICAL LISTING

<u>MNE-MONIC</u>	<u>F</u>	<u>AD-DRESS-</u>	<u>NAME</u>	<u>TIME (Major Cycles)</u>
ACN	74	d	Activate channel d	2
ADC	21	dm	Add dm	2
ADD	31	d	Add (d)	2
ADI	41	d	Add ((d))	3
ADM	51	m d	Add (m + (d))	3-4
ADN	16	d	Add d	1
AJM	64	m d	Jump to m if channel d active	2
AOD	36	d	Replace add one (d)	3
AOI	46	d	Replace add one ((d))	4
AOM	56	m d	Replace add one (m + (d))	4-5
CRD	60	d	Central read from (A) to d	min. 6
CRM	61	m d	Central read (d) words from (A) to m	5 plus 5/word
CWD	62	d	Central write to (A) from d	min. 6
CWM	63	m d	Central write (d) words to (A) from m	5 plus 5/word
DCN	75	d	Disconnect channel d	2
EJM	67	m d	Jump to m if channel d empty	2
EXN	260		Exchange jump*	
FAN	76	d	Function (A) on channel d	2
FJM	66	m d	Jump to m if channel d full	2
FNC	77	m d	Function m on channel d	2
IAM	71	m d	Input (A) words to m from channel d	4 plus 1/word
IAN	70	d	Input to A from channel d	2

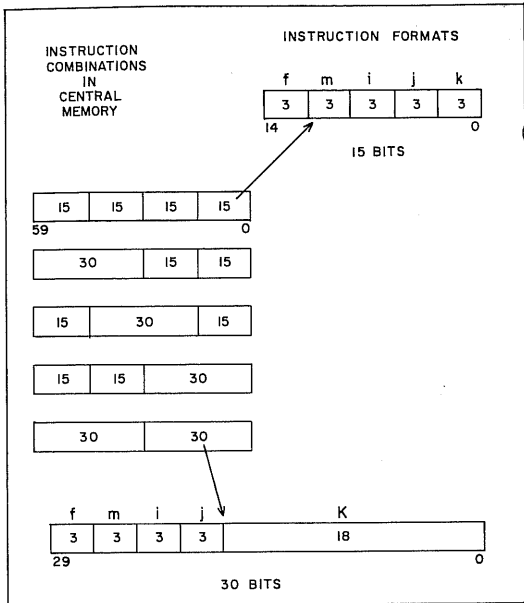
*In the 6500 System, Bit 0 specifies which CP the Exchange Jump will interrupt.

<u>MNE- MONIC</u>	<u>F</u>	<u>AD- DRESS</u>	<u>NAME</u>	<u>TIME (Major Cycles)</u>
IJM	65	m d	Jump to m if channel d inactive	2
LCN	15	d	Load complement d	1
LDC	20	m	Load dm	2
LDD	30	d	Load (d)	2
LDI	40	d	Load ((d))	3
LDM	50	m d	Load (m + (d))	3-4
LDN	14	d	Load d	1
LJM	01	m d	Long jump to m + (d)	2-3
LMC	23	dm	Logical difference dm	2
LMD	33	d	Logical difference (d)	2
LMI	43	d	Logical difference ((d))	3
LMM	53	m d	Logical difference (m+(d))	3-4
LMN	11	d	Logical difference d	1
LPC	22	dm	Logical product dm	2
LPN	12	d	Logical product d	1
MXN	261		Monitor exchange jump*	
MJN	07	d	Minus jump d	1
NJN	05	d	Nonzero jump d	1
OAM	73	m d	Output (A) words from m on channel d	4 plus 1/word
OAN	72	d	Output from A on channel d	2
PJN	06	d	Plus jump d	1
PSN	00		Pass	1
PSN	24		Pass	1
PSN	25		Pass	1

*Standard option 10103 for 6400, Standard option
10104 for 6600.

<u>MNE- MONIC</u>	<u>F</u>	<u>AD- DRESS</u>	<u>NAME</u>	<u>TIME (Major Cycles)</u>
RAD	35	d	Replace add (d)	3
RAI	45	d	Replace add ((d))	4
RAM	55	m d	Replace add (m + (d))	4-5
RJM	02	m d	Return jump to m + (d)	3-4
RPN	27		Read program address	1
SBD	32	d	Subtract (d)	2
SBI	42	d	Subtract ((d))	3
SBM	52	m d	Subtract (m+(d))	3-4
SBN	17	d	Subtract d	1
SCN	13	d	Selective clear d	1
SHN	10	d	Shift d	1
SOD	37	d	Replace subtract one (d)	3
SOI	47	d	Replace subtract one ((d))	4
SOM	57	m d	Replace subtract one (m + (d))	4-5
STD	34	d	Store (d)	2
STI	44	d	Store ((d))	3
STM	54	m d	Store (m + (d))	3-4
UJN	03	d	Unconditional jump d	1
ZJN	04	d	Zero jump d	1

EXPLANATION OF CENTRAL PROCESSOR INSTRUCTION FORMATS



EXPLANATION OF SYMBOLS USED IN CENTRAL PROCESSOR INSTRUCTION LISTINGS

- A One of eight address registers (18 bits)
- B One of eight index registers (18 bits)
BO is fixed and equal to zero
- fm Instruction code (6 bits)
- i Specifies which of eight designated registers (3 bits). Is also used in 03X instructions as part of a 9-bit operation code.
- j Specifies which of eight designated registers (3 bits)
- jk Constant, indicating number of shifts to be taken (6 bits)
- k Specifies which of eight designated registers (3 bits)
- K Constant, indicating branch destination or operand (18 bits)
- X One of eight operand registers (60 bits)

CENTRAL PROCESSOR INSTRUCTIONS

1. NUMERICAL LISTING

(Functional unit designation does not apply to 6400/6500).

BRANCH UNIT*

<u>fm</u> <u>(i)</u>	<u>MNE-</u> <u>MONIC</u>	<u>AD-</u> <u>DRESS</u>	<u>NAME</u>
00	PS		Program stop
010	RJ	K	Return jump to K
011	REC	Bj + K	Read extended core storage
012	WEC	Bj + K	Write extended core storage
013	XJ		Central exchange jump**
02	JP	Bi + K	Go to Bi + K
030	ZR	Xj K	Go to K if Xj = 0
031	NZ	Xj K	Go to K if Xj ≠ 0
032	PL	Xj K	Go to K if Xj = plus (positive)
033	NG	Xj K	Go to K if Xj = negative
034	IR	Xj K	Go to K if Xj is in range
035	OR	Xj K	Go to K if Xj is out of range
036	DF	Xj K	Go to K if Xj is definite
037	ID	Xj K	Go to K if Xj is indefinite
***04	EQ	BiBjK	Go to K if Bi = Bj
04	ZR	Bi K	Go to K if Bi = B0
05	NE	BiBjK	Go to K if Bi ≠ Bj
***05	NZ	Bi K	Go to K if Bi ≠ B0
06	GE	BiBjK	Go to K if Bi ≥ Bj
***06	PL	Bi K	Go to K if Bi ≥ B0
07	LT	BiBjK	Go to K if Bi < Bj
*07	NG	Bi K	Go to K if Bi < B0

*Go to K + Bi and Go To K if Bi - tests made in increment unit.

Go to K if Xj - tests made in long add unit.

**Standard Option 10103 for 6400. Standard Option 10104 for 6600. If option is not installed, this is an illegal instruction.

*For these instructions, ASCENT packs the instruction so Bi is compared with B0 rather than Bj.

BOOLEAN UNIT

<u>fm</u> <u>(i)</u>	<u>MNE-</u> <u>MONIC</u>	<u>AD-</u> <u>DRESS</u>	<u>NAME</u>
10	BXi	Xj	Transmit Xj to Xi
11	BXi	Xj*Xk	Logical Product of Xj & Xk to Xi
12	BXi	Xj+Xk	Logical sum of Xj & Xk to Xi
13	BXi	Xj-Xk	Logical difference of Xj & Xk to Xi
14	BXi	-Xk	Transmit the comp. of Xk to Xi
15	BXi	-Xk*Xj	Logical product of Xj & Xk comp. to Xi
16	BXi	-Xk+Xj	Logical sum of Xj & Xk comp. of Xi
17	BXi	-Xk-Xj	Logical difference of Xj & Xk comp. to Xi

SHIFT UNIT

20	LXi	jk	Left shift Xi, jk places
21	AXi	jk	Arithmetic right shift Xi, jk places
22	LXi	Bj Xk	Left shift Xk nominally Bj places to Xi
23	AXi	Bj Xk	Arithmetic right shift Xk nominally Bj places to Xi
24	NXi	Bj Xk	Normalize Xk in Xi and Bj
25	ZXi	Bj Xk	Round and normalize Xk in Xi and Bj
26	UXi	Bj Xk	Unpack Xk to Xi and Bj
27	PXi	Bj Xk	Pack Xi from Xk and Bj
43	MXi	jk	Form mask in Xi, jk bits

ADD UNIT

30	FXi	Xj+Xk	Floating sum of Xj and Xk to Xi
31	FXi	Xj-Xk	Floating difference Xj and Xk to Xi
32	DXi	Xj+Xk	Floating DP sum of Xj and Xk to Xi
33	DXi	Xj-Xk	Floating DP difference of Xj and Xk to Xi

ADD UNIT (Cont'd)

<u>fm</u> <u>(i)</u>	<u>MNE-</u> <u>MONIC</u>	<u>AD-</u> <u>DRESS</u>	<u>NAME</u>
34	RXi	$X_j + X_k$	Round floating sum of X_j and X_k to X_i
35	RXi	$X_j - X_k$	Round floating difference of X_j and X_k to X_i
36	IXi	$X_j + X_k$	Integer sum of X_j and X_k to X_i
37	IXi	$X_j - X_k$	Integer difference of X_j and X_k to X_i

MULTIPLY UNIT

40	FXi	$X_j * X_k$	Floating product of X_j and X_k to X_i
41	RXi	$X_j * X_k$	Round floating product of X_j & X_k to X_i
42	DXi	$X_j * X_k$	Floating DP product of X_j & X_k to X_i

DIVIDE UNIT

44	FXi	X_j / X_k	Floating divide X_j by X_k to X_i
45	RXi	X_j / X_k	Round floating divide X_j by X_k to X_i
46	NO		No operation
47	CXi	X_k	Count the number of 1's in X_k to X_i

INCREMENT UNIT

50	SAi	$A_j + K$	Set A_i to $A_j + K$
*50	SAi	$A_j - K$	Set A_i to $A_j + \text{comp. of } K$
51	SAi	$B_j + K$	Set A_i to $B_j + K$
*51	SAi	$B_j - K$	Set A_i to $B_j + \text{comp. of } K$
52	SAi	$X_j + K$	Set A_i to $X_j + K$
*52	SAi	$X_j - K$	Set A_i to $X_j + \text{comp. of } K$

* If the sign in the address field is minus, ASCENT complements the 18-bit quantity K.

INCREMENT UNIT (Cont'd)

<u>fm</u> <u>(i)</u>	<u>MNE-</u> <u>MONIC</u>	<u>AD-</u> <u>DRESS</u>	<u>NAME</u>
53	SAi	Xj + Bk	Set Ai to Xj + Bk
54	SAi	Aj + Bk	Set Ai to Aj + Bk
55	SAi	Aj - Bk	Set Ai to Aj - Bk
56	SAi	Bj + Bk	Set Ai to Bj + Bk
57	SAi	Bj - Bk	Set Ai to Bj - Bk
60	SBi	Aj + K	Set Bi to Aj + K
*60	SBi	Aj - K	Set Bi to Aj + comp. of K
61	SBi	Bj + K	Set Bi to Bj + K
*61	SBi	Bj - K	Set Bi to Bj + comp. of K
62	SBi	Xj + K	Set Bi to Xj + K
*62	SBi	Xj - K	Set Bi to Xj + comp. of K
63	SBi	Xj + Bk	Set Bi to Xj + Bk
64	SBi	Aj + Bk	Set Bi to Aj + Bk
65	SBi	Aj - Bk	Set Bi to Aj - Bk
66	SBi	Bj + Bk	Set Bi to Bj + Bk
67	SBi	Bj - Bk	Set Bi to Bj - Bk
70	SXi	Aj + K	Set Xi to Aj + K
*70	SXi	Aj - K	Set Xi to Aj + comp. of K
71	SXi	Bj + K	Set Xi to Bj + K
*71	SXi	Bj - K	Set Xi to Bj + comp. of K
72	SXi	Xj + K	Set Xi to Xj + K
*72	SXi	Xj - K	Set Xi to Xj + comp. of K
73	SXi	Xj + Bk	Set Xi to Xj + Bk
74	SXi	Aj + Bk	Set Xi to Aj + Bk
75	SXi	Aj - Bk	Set Xi to Aj - Bk
76	SXi	Bj + Bk	Set Xi to Bj + Bk
77	SXi	Bj - Bk	Set Xi to Bj - Bk

*If the sign in the address field is minus, ASCENT complements the 18-bit quantity K.

2. ALPHABETICAL LISTING

<u>MNE- MONIC</u>	<u>fm (i)</u>	<u>AD- DRESS</u>	<u>NAME</u>
AXi	21	jk	Arithmetic right shift X_i , jk places
AXi	23	$B_j X_k$	Arithmetic right shift X_k nominally B_j places to X_i
BXi	10	X_j	Transmit X_j to X_i
BXi	11	$X_j * X_k$	Logical product of X_j & X_k to X_i
BXi	12	$X_j + X_k$	Logical sum of X_j & X_k to X_i
BXi	13	$X_j - X_k$	Logical difference of X_j & X_k to X_i
BXi	14	$-X_k$	Transmit the comp. of X_k to X_i
BXi	15	$-X_k * X_j$	Logical product of X_j & X_k comp. to X_i
BXi	16	$-X_k + X_j$	Logical sum of X_j & X_k comp. to X_i
BXi	17	$-X_k - X_j$	Logical difference of X_j & X_k comp. to X_i
CXi	47	X_k	Count the number of 1's in X_k to X_i
DF	036	$X_j K$	Go to K if X_j is definite
DXi	32	$X_j + X_k$	Floating DP sum of X_j and X_k to X_i
DXi	33	$X_j - X_k$	Floating DP difference of X_j and X_k to X_i
DXi	42	$X_j * X_k$	Floating DP product of X_j & X_k to X_i
EQ	04	$B_i B_j K$	Go to K if $B_i = B_j$
FXi	30	$X_j + X_k$	Floating sum of X_j and X_k to X_i
FXi	31	$X_j - X_k$	Floating difference X_j and X_k to X_i
FXi	40	$X_j * X_k$	Floating product of X_j and X_k to X_i
FXi	44	X_j / X_k	Floating divide X_j by X_k to X_i
GE	06	$B_i B_j K$	Go to K if $B_i \geq B_j$

<u>MNE-MONIC</u>	<u>fm</u> <u>(i)</u>	<u>AD-DRESS</u>	<u>NAME</u>
ID	037	Xj K	Go to K if Xj if indefinite
IR	034	Xj K	Go to K if Xj is in range
IXi	36	Xj+Xk	Integer sum of Xj and Xk to Xi
IXi	37	Xj-Xk	Integer difference of Xj and Xk to Xi
JP	02	Bi+Bk	Go to Bi + K
LT	07	BiBjK	Go to K if Bi < Bj
LXi	20	jk	Left shift Xi, jk places
LXi	22	Bj Xk	Left shift Xk nominally Bj places to Xi
XJ	013		Central exchange jump*
MXi	43	jk	Form mask in Xi, jk bits
NE	05	BiBjK	Go to K if Bi ≠ Bj
NG	033	Xj K	Go to K if Xj = negative
NG	**07	Bi K	Go to K if Bi < B0
NO	46		No operation
NXi	24	Bi Xk	Normalize Xk in Xi and Bj
NZ	031	Xj K	Go to K if Xj ≠ 0
NZ	**05	Bi K	Go to K if Bi ≠ B0
OR	035	Xj K	Go to K if Xj is out of range
PL	032	Xj K	Go to K if Xj = plus (positive)
PL	06	Bi K	Go to K if Bi ≥ B0
PS	00		Program stop
PXi	27	Bj Xk	Pack Xi from Xk and Bj
REC	011	Bj+K	Read extended core storage
RJ	01	K	Return jump to K
RXi	34	Xj+Xk	Round floating sum of Xj and Xk to Xi
RXi	35	Xj-Xk	Round floating difference of Xj and Xk to Xi
RXi	41	Xj*Xk	Round floating product of Xj & Xk to Xi
RXi	45	Xj/Xk	Round floating divide Xj by Xk to Xi

*Standard Option 10103 for 6400. Standard Option 10104 for 6600. If option is not installed, this is an illegal instruction.

**If the sign in the address field is minus, ASCENT complements the 18-bit quantity K.

<u>MNE-</u> <u>MONIC</u>	<u>fm</u> <u>(i)</u>	<u>AD-</u> <u>DRESS</u>	<u>NAME</u>
SAi	50	Aj+K	Set Ai to Aj + K
SAi	*50	Aj-K	Set Ai to Aj + comp. of K
SAi	51	Bj+K	Set Ai to Bj + K
SAi	*51	Bj-K	Set Ai to Bj + comp. of K
SAi	52	Xj+K	Set Ai to Xj + K
SAi	*52	Xj-K	Set Ai to Xj + comp. of K
SAi	53	Xj+Bk	Set Ai to Xj + Bk
SAi	54	Aj+Bk	Set Ai to Aj + Bk
SAi	55	Aj-Bk	Set Ai to Aj - Bk
SAi	56	Bj+Bk	Set Ai to Bj + Bk
SAi	57	Bj-Bk	Set Ai to Bj - Bk
SBi	60	Aj+K	Set Bi to Aj + K
SBi	*60	Aj-K	Set Bi to Aj + comp. of K
SBi	61	Bj+K	Set Bi to Bj + K
SBi	*61	Bj-K	Set Bi to Bj + comp. of K
SBi	62	Xj+K	Set Bi to Xj + K
SBi	*62	Xj-K	Set Bi to Xj + comp. of K
SBi	63	Xj+Bk	Set Bi to Xj + Bk
SBi	64	Aj+Bk	Set Bi to Aj + Bk
SBi	65	Aj-Bk	Set Bi to Aj - Bk
SBi	66	Bj+Bk	Set Bi to Bj + Bk
SBi	67	Bj-Bk	Set Bi to Bj - Bk
SXi	70	Aj+K	Set Xi to Aj + K
SXi	*70	Aj-K	Set Xi to Aj + comp. of K
SXi	71	Bj+K	Set Xi to Bj + K
SXi	*71	Bj-K	Set Xi to Bj + comp. of K
SXi	72	Xj+K	Set Xi to Xk + K
SXi	*72	Xj-K	Set Xi to Xj + comp. of K
SXi	73	Xj+Bk	Set Xi to Xj + Bk
SXi	74	Aj+Bk	Set Xi to Aj + Bk
SXi	75	Aj-Bk	Set Xi to Aj - Bk
SXi	76	Bj+Bk	Set Xi to Bj + Bk
SXi	77	Bj-Bk	Set Xi to Bj - Bk

*If the sign in the address field is minus, ASCENT complements the 18-bit quantity K.

<u>MNE-</u> <u>MONIC</u>	<u>fm</u> <u>(i)</u>	<u>AD-</u> <u>DRESS</u>	<u>NAME</u>
UXi	26	Bj Xk	Unpack Xk to Xi and Bj
WEC	012	Bj+K	Write extended core storage.
ZR	030	Xj K	Go to K if Xj = 0
ZR	*04	Bi K	Go to K if Bi = B0
ZXi	25	Bj Xk	Round and normalize Xk in Xi and Bj

3. EXIT MODES

- EM = 000000 Stop
- = 010000 Address out of range - an attempt to reference memory outside established limits
- = 020000 Operand out of range - floating point arithmetic generated or regenerated an infinite result
- = 030000 Address or operand out of range
- = 040000 Indefinite operand - floating point arithmetic generated or regenerated an indefinite result
- = 050000 Indefinite operand or address out of range
- = 060000 Indefinite operand or operand out of range
- = 070000 Address or operand out of range, or indefinite operand
- EM = Bits 48, 49, 50 of location n + 3 of Exchange Jump package. Other bits of EM word are irrelevant.

*For these instructions, ASCENT packs the instruction so Bi is compared with B0 rather than Bj.

4. INSTRUCTION EXECUTION TIMES

All times are given in minor cycles:
One minor cycle = 100 nanoseconds

OCTAL CODE		6400/	
		6500	6600
00	Stop	-	-
01	Return Jump to K	21	13
011	Read Extended Core Storage	††	††
012	Write Extended Core Storage	††	††
02	Go to K + Bi	†††13	14
030	Go to K if Xj = zero	†††13	9†
031	Go to K if Xj ≠ zero	†††13	9†
032	Go to K if Xj = positive	†††13	9†
033	Go to K if Xj = negative	†††13	9†
034	Go to K if Xj is in range	†††13	9†
035	Go to K if Xj is out of range	†††13	9†
036	Go to K if Xj is definite	†††13	9†
037	Go to K if Xj is indefinite	†††13	9†
04	Go to K if Bi = Bj	†††13	8†
05	Go to K if Bi = Bj	†††13	8†
06	Go to K if Bi ≥ Bj	†††13	8†
07	Go to K if Bi < Bj	†††13	8†
10	Transmit Xj to Xi	5	3
11	Logical Product of Xj and Xk to Xi	5	3
12	Logical Sum of Xj and Xk to Xi	5	3
13	Logical Difference of Xj and Xk to Xi	5	3
14	Transmit Xk comp. to Xi	5	3
15	Logical Product of Xj and Xk comp. to Xi	5	3
16	Logical Sum of Xj and Xk comp. to Xi	5	3
17	Logical Difference of Xj and Xk comp. to Xi	5	3

†Modify the execution time (T) according to this table.

	Branch	No Branch
Loop (in stack)	T	T+2
Jump (out of stack)	T+6	T+5

††See ECS literature for timing information.

†††No branch condition requires 5 minor cycles.

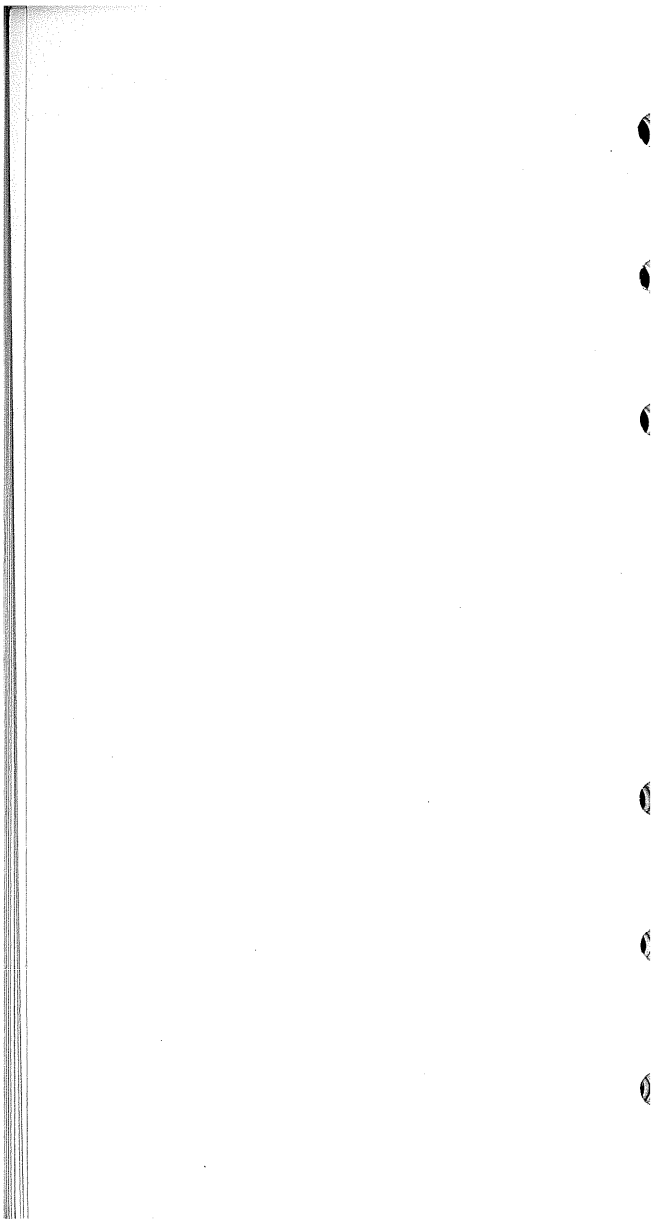
OCTAL CODE		6400/	
		6500	6600
20	Shift Xi Left jk places	6	3
21	Shift Xi Right jk places	6	3
22	Shift Xk Nominally Left Bj places to Xi	6	3
23	Shift Xk Nominally Right Bj places to Xi	6	3
24	Normalize Xk in Xi and Bj	7	4
25	Round and Normalize Xk in Xi and Bj	7	4
26	Unpack Xk to Xi and Bj	7	3
27	Pack Xi from Xk and Bj	7	3
43	Form jk Mask in Xi	6	3
30	Floating Sum of Xj and Xk to Xi	11	4
31	Floating Difference of Xj and Xk to Xi	11	4
32	Floating DP Sum of Xj and Xk to Xi	11	4
33	Floating DP Difference of Xj and Xk to Xi	11	4
34	Round Floating Sum of Xj and Xk to Xi	11	4
35	Round Floating Difference of Xj and Xk to Xi	11	4
36	Integer Sum of Xj and Xk to Xi	6	3
37	Integer Difference of Xj and Xk to Xi	6	3
40	Floating Product of Xj and Xk to Xi	57	10
41	Round Floating Product of Xj, and Xk to Xi	59	10
42	Floating DP Product of Xj and Xk to Xi	57	10
44	Floating Divide Xj by Xk to Xi	56	29
45	Round Floating Divide Xj by Xk to Xi	57	29
46	Pass	3	1
47	Sum of 1's in Xk to Xi	68	8
50	Sum of Aj and K to Ai	†	3
51	Sum of Bj and K to Ai	†	3
52	Sum of Xj and K to Ai	†	3
53	Sum of Xj and Bk to Ai	†	3
54	Sum of Aj and Bk to Ai	†	3
55	Difference of Aj and Bk to Ai	†	3
56	Sum of Bj and Bk to Ai	†	3
57	Difference of Bj and Bk to Ai	†	3
60	Sum of Aj and K to Bi	5	3
61	Sum of Bj and K to Bi	5	3
62	Sum of Xj and K to Bi	5	3

†When $i = 0$; time = 6 minor cycles
 $i = 1-5$; time = 12 minor cycles
 $i = 6-7$; time = 10 minor cycles

OCTAL
CODE

6400/
6500 6600

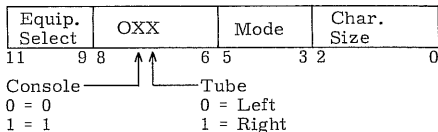
63	Sum of Xj and Bk to Bi	5	3
64	Sum of Aj and Bk to Bi	5	3
65	Difference of Aj and Bk to Bi	5	3
66	Sum of Bj and Bk to Bi	5	3
67	Difference of Bj and Bk to Bi	5	3
70	Sum of Aj and K to Xi	6	3
71	Sum of Bj and K to Xi	6	3
72	Sum of Xj and K to Xi	6	3
73	Sum of Xj and Bk to Xi	6	3
74	Sum of Aj and Bk to Xi	6	3
75	Difference of Aj and Bk to Xi	6	3
76	Sum of Bj and Bk to Xi	6	3
77	Difference of Bj and Bk to Xi	6	3



EXTERNAL FUNCTION CODES AND STATUS RESPONSES

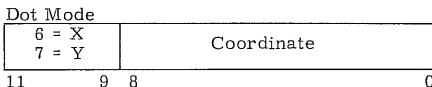
1. 6602/6612 CONSOLE DISPLAY

Function Word



Console 0	Console 1	
7000	7200	Select 64 Char./Line, Left Screen
7001	7201	Select 32 Char./Line, Left Screen
7002	7202	Select 16 Char./Line, Left Screen
7010	7210	Select 512 Dots/Line
7020	7220	Select Keyboard Input
7100	7300	Select 64 Char./Line, Right Screen
7101	7301	Select 32 Char./Line, Right Screen
7102	7302	Select 16 Char./Line, Right Screen

Data Word

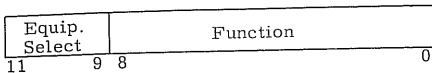


Character Mode



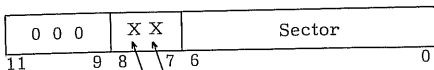
2. 6603 DISK SYSTEM

Function Word



10XX	Read Sector XX (sectors 00-77)
11XX	Read Sector XX (sectors 100-177)
12XX	Write Sector XX (sectors 00-77)
13XX	Write Sector XX (sectors 100-177)
14XX	Select Track XX (tracks 00-77)
15XX	Select Track XX (tracks 100-177)
16YX*	Select Head Group X
1700	Status Request

Status Reply Word



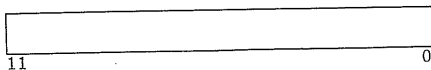
0 = Ready

1 = Not Ready

0 = No Parity Error

1 = Parity Error

Data Word



* Y is a function of the read sample time. Normal sampling occurs when Y = 0.

3. 6622 MAGNETIC TAPE CONTROLLER (626-B MAGNETIC TAPE UNIT)

Function Word

Equip. Select	Function	Unit
11	9 8	3 2 0

300X	Select
301X	Write Binary
302X	Read Binary
303X	Backspace
306X	Rewind
307X	Rewind Unload
3100	Status Request
361X	Write File Mark

(X = Unit = 0-7)

Status Reply:	0000 = Ready
	0001 = Not Ready
	0002 = Parity Error
	0004 = Load Point
	0010 = End of Tape
	0020 = File Mark
	0040 = Write Lockout

Data Word

11	0
----	---

Position Select Function Code

Equipment	Position Select	Retract	Position Address
11 ← → 9	8 ← → 6	5	4 ← → 0

- 14 1xx X Position Select and Retract Heads*
 14 0xx X Position Select and do not Retract Heads.*

Head Group Select Function Code

Equipment	Function	Sector Address
11 ← → 9	8 ← → 6	5 ← → 0

16 XX Head Group Select Function Code

Read/Write Function Code

Equipment	Function	Sector Address
11 ← → 9	8 ← → 6	5 ← → 0

- 1 01x XX Write Function Code*
 1 00x XX Read Function Code*

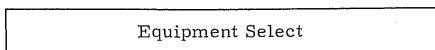
Disconnect Function Code

Equipment	Function	Not Used
11 ← → 9	8 ← → 5	4 ← → 0

- 1 1x1 1xx X Disconnect Function Code*

* Small digits are binary numbers; large digits are octal numbers.

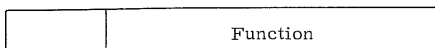
5. 6681 DATA CHANNEL CONVERTER (3000 SERIES INTERFACE)



11 0

2000	Select
2100	Deselect

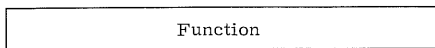
Mode I Function Word



11 8 0

Connect:	4XXX	Connect External Equipment 4
	5XXX	Connect External Equipment 5
	6XXX	Connect External Equipment 6
	7XXX	Connect External Equipment 7
Function:	0XXX	Send 9-bit Function Code to External Equipment Connected

Mode II Function Word



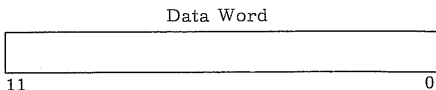
11 0

Connect:	1000	Select 6681 to Output a 12-bit Connect Code
Function:	1100	Select 6681 to Output a 12-bit Function Code to External Equipment Connected

Status:	1200	6681 Status Request
	1300	External Equipment Status Request
Status Reply:	XXX1	Reject (internal or external)
	XXX2	Internal Reject
	XXX4	Transmission Parity Error
	XX1X - 2XXX	Eight Interrupt Lines
Data I/O:	1400	Input to End of Record
	1500	Input until computer sends Inactive signal
	1600	Output until computer sends Inactive signal

A "1" in the lowest bit of Data I/O codes negates BCD conversion. The BCD negated is normal mode of operation.

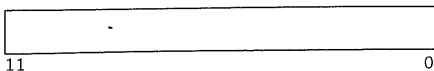
1700 Master Clear



NOTE: For 3000 Series peripheral equipment codes, refer to Pub. No. 60113400.

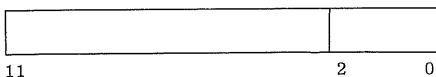
6. 6682/6683 SATELLITE COUPLER

Equipment Select



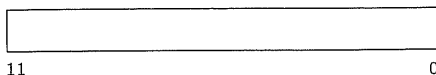
*S000	Output
S100	Input
S200	Status Request

Status



XXX1	Output Channel Request
XXX2	Input Channel Request
XXX4	Busy

Data Word



*S is determined by machine installation.

7. 6411/6416 AUGMENTED I/O BUFFER AND CONTROL

All instructions are the same as 6600 Peripheral Processors except:

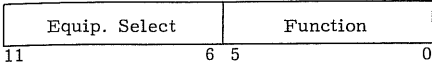
- | | | | |
|----|-----|---|--|
| 26 | ECT | d | Extended Core Transfer; initiate Extended Core Storage operation |
| 27 | RCS | d | Read Extended Core Coupler status |

- Status Reply: (Read into upper 3 bits of Peripheral Processor A Register)
- | | |
|--------|--|
| Bit 17 | Extended Core Storage Transfer in progress |
| Bit 16 | Parity error occurred during last Read Extended Core Storage operation |
| Bit 15 | At least one address of the last Extended Core Storage Transfer was not available (Power off, in Maintenance mode, address not in system). |

8. 1612 PRINTER

(Special Option 60022)

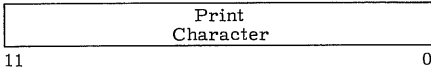
Function Word



0600	Select Printer
0601	Single Space
0602	Double Space
0603	Move Paper to Format Channel 7
0604	Move Paper to Top of Form
0605	Print
0606	Suppress Line Advance After Next Print
0607	Status Request
0610	Clear Format Channels
061X	Select Format Channel X (X = 1-6)

Status Reply:	0000	Not Ready
	4000	Ready

Data Word



9. 170 CARD PUNCH

(Special Option 60022)

Function Word

Equip. Select	Function
11	6 5 0

3000 Deselect
 3002 Select Punch
 3040 Status Request

Status Reply: 0000 = Ready
 0200 = Manual Switch in 1604
 Position
 2000 = Not Ready

Data Word

11	0
----	---

Word Assembly Sequence

Col.	1	12 13	24 25	36 37	48
	1st Word	2nd Word	3rd Word	4th Word	
					Col.
	49	60 61	72 73	80	
	5th Word	6th Word	7th Word		

10. 607-B MAGNETIC TAPE UNIT

(Special Option 60028)

Function Word

Equip. Select	Function	Unit
11 9 8	3 2	0

200X	Select
201X	Write Binary
202X	Read Binary
203X	Backspace
206X	Rewind
207X	Rewind Unload
2100	Status Request
221X	Write BCD
222X	Read BCD
261X	Write File Mark

(X = unit = 0-7)

Status Reply: 0X00 = Ready
 0X01 = Not Ready
 0X02 = Parity Error
 0X04 = Load Point
 0X10 = End of Tape
 0X20 = File Mark
 0X40 = Write Lockout

X = 0: 800 bpi
 X = 1: 556 bpi
 X = 2: 200 bpi

Data Word

First Char.	Second Char.
11 6 5	0

CONSOLE DISPLAY CODES

<u>CHAR.</u>	<u>CODE</u>	<u>CHAR.</u>	<u>CODE</u>
(space)	00	X	30
A	01	Y	31
B	02	Z	32
C	03	0	33
D	04	1	34
E	05	2	35
F	06	3	36
G	07	4	37
H	10	5	40
I	11	6	41
J	12	7	42
K	13	8	43
L	14	9	44
M	15	+	45
N	16	-	46
O	17	*	47
P	20	/	50
Q	21	(51
R	22)	52
S	23	blank	53
T	24	=	54
U	25	blank	55
V	26	,	56
W	27	.	57

Keyboard codes are identical with the following exceptions:

No Data	00
Carriage Return	60
Backspace	61
Space	62

PRINTER CODES (EXT. BCD)

<u>CHAR.</u>	<u>CODE</u>	<u>CHAR.</u>	<u>CODE</u>
(blank)	20	V	25
0	12	W	26
1	01	X	27
2	02	Y	30
3	03	Z	31
4	04	.	73
5	05	- (minus)	40
6	06	+	60
7	07	=	13
8	10	(34
9	11)	74
A	61	*	54
B	62	,	33
C	63	:	00
D	64	≠	14
E	65	/	21
F	66	≤	15
G	67	%	16
H	70	[17
I	71]	32
J	41	→	35
K	42	≡	36
L	43	∧ (and)	37
M	44	∨ (or)	52
N	45	\$	53
O	46	↑	55
P	47	↓	56
Q	50	>	57
R	51	<	72
S	22	≡	75
T	23	⊄ (not)	76
U	24	;	77

HOLLERITH PUNCH CARD CODES

<u>CHAR.</u>	<u>CODE</u>	<u>CHAR.</u>	<u>CODE</u>
A	12-1	Y	0-8
B	12-2	Z	0-9
C	12-3	0	0
D	12-4	1	1
E	12-5	2	2
F	12-6	3	3
G	12-7	4	4
H	12-8	5	5
I	12-9	6	6
J	11-1	7	7
K	11-2	8	8
L	11-3	9	9
M	11-4	/	0-1
N	11-5	+	12
O	11-6	- (dash)	11
P	11-7	blank	space
Q	11-8	.	12-8-3
R	11-9)	12-8-4
S	0-2	\$	11-8-3
T	0-3	*	11-8-4
U	0-4	,	0-8-3
V	0-5	(0-8-4
W	0-6	=	8-3
X	0-7	-	8-4



CONTROL DATA

CORPORATION

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